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10 **BEVERAGE VENDING MACHINE WITH CUP RELEASE  
DEVICE**

**DESCRIPTION**

15 The present invention refers to a beverage vending machine provided  
with a cup release device.

Largely known in the art are currently beverage vending machines for  
dispensing beverages filled into cups, which comprise a movable turret  
20 accommodating one or more stacks of cups, as well as devices enabling  
such cups to be pulled out one at a time, in view to be then filled with a  
selected beverage. These devices are known to exist in a variety of forms  
and embodiments. A very simple one among these embodiments is  
constituted by a pair of spirals arranged at the base of said turret close to  
25 the outlet section of a stack of cups, so as to be able to interact with the  
upper edge of a cup and cause the latter to be released from the stack  
through a rotation about the coiling axis thereof. However, a device of  
such kind has a number of drawbacks. One of such drawbacks is for  
instance due to the fact that the device is not capable of working as  
30 efficiently when it is due to release differently sized or shaped cups, or  
when the clearance or spacing between the upper edges of two successive  
cups in a stack is not constant. In practice, this may cause two or more

stacked cups to be released at the same time, thereby bringing about a situation that may in turn quite easily cause the vending machine to get jammed with a resulting loss in revenues for those who run the vending business.

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A further drawback connected to these devices based on the use of rotating spirals lies in the fact that they make use of the force of gravity for releasing a cup from a stack. In fact, if the stacked cups are provided to already contain the product needed for the preparation of the final  
10 beverage, their falling down caused by the action of the spirals entails a partial loss of said products from the cups themselves, so that the resulting spillage scatters all over the vending machine with a diffuse soiling effect.

15 Another type of device used to release a cup from a stack is disclosed in the US patent publication No. 4,327,843. This device consists of an arm that has its fulcrum on a pivot and is provided of an appropriately shaped end portion cooperating with a kind of jaw to clamp a cup and pull it out of the stack holding it. In this device, the removal of the cup from the  
20 stack occurs by exerting a pulling force upon the same cup until the upper edge thereof causes some movable jutting parts that are provided around the outlet section of the compartment accommodating the stack of cups, and which engage said upper edge in order to support the same stack, to open out apart. The cup being so removed from the stack is then  
25 dispensed by letting it fall down by gravity upon simply releasing it from the grip of the arm. The cup release device disclosed in US 4,327,843 shares the same drawback as the afore-described prior-art device concerning the spillage, and resulting scattering inside the vending machine, of the products that may be possibly held in the stacked cups,  
30 when the same cups are so removed from the stack for the preparation of the beverage.

A further drawback of this device lies in the fact that the movement of the juts supporting the stack of cups is caused and controlled by the displacement of the cup being removed and this by no means ensures that a single cup is actually removed each time. As a matter of fact, in the case  
5 that two successive cups in a stack happen to somehow get or be stuck into each other, the gripping arm would clamp both of them and the juts would be pushed apart by both upper edges of the two cups. In other words, the sole pulling action exerted on the cup to be removed might not prove sufficient to separate from each other two cups that are so stuck  
10 into each other, especially if the spacing between the upper edges of such successive cups in a stack is so small that said upper edges come to almost rest against each other.

It therefore is the object of the present invention to provide a beverage  
15 vending machine, which is provided with a cup release device that does away with the drawbacks of vending machines equipped prior-art cup release devices of the above indicated kind.

Within this general object, it is a purpose of the present invention to  
20 provide a beverage vending machine provided with a cup release device, which is effective in ensuring that a single cup at a time is released from a stack, regardless of the size of such cup, the spacing separating a cup from a successive one in said stack, and the material which the cup is made of.

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Another purpose of the present invention is to provide a beverage vending machine provided with a cup release device, which is effective in preventing possible products contained in each cup of a stack for the preparation of a final beverage from spilling over and scattering inside the  
30 vending machine.

Another purpose yet of the present invention is to provide a beverage vending machine provided with a cup release device, which requires a single drive unit for actuating said device.

5       According to the present invention, the above-noted aims are reached in a beverage vending machine provided with a cup release device, which incorporates the features and characteristics as recited in the appended claims.

10       Features and advantages of the present invention will anyway be more readily understood from the description that is given below by way of non-limiting example with reference to the accompanying drawings, in which:

- Figure 1 is a schematical view of a beverage vending machine  
15       according to the present invention, comprising a cup release device;

- Figure 2 is a schematical view of an arm for separating and removing cups from a stack, as shown in a first release position thereof;

20       - Figure 3 is a schematical view of the arm illustrated in Figure 2, as shown in a second gripping position thereof;

- Figure 4 is a partially cross-sectional of a cup release device;

25       - Figure 5 is a cross-sectional view of a cup release device, as shown in a first release phase;

- Figure 6 is a cross-sectional view of a cup release device, as shown in a second release phase;

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- Figure 7 is a cross-sectional view of a cup release device, as shown in a third release phase.

Figure 1 illustrates schematically a vending machine 1 provided with a door 2 that closes a chamber 3 defined by the walls of a cabinet or outer casing 4. The door 2 is in turn provided with an aperture that forms a dispensing site 5 for taking out the beverage prepared by the vending machine 1. On the door 2 there is also provided a selection device 6 of a kind known as such in the art, such as for instance a push-button panel or unit, for buyers to select the beverage they wish to drink. This selector device 6 may also integrate means for paying the selected beverage, as they may for instance be constituted by a magnetic card reader or a coin collector. The vending machine 1 may of course comprise more than a single dispensing site 5, according to the actual requirements and needs.

Within the chamber 3 there is arranged a turret 7 provided with one or more accommodations 8 adapted to receive and hold a corresponding number of stacks 9 of cups. The turret 7 is preferably rotating about the longitudinal axis thereof and may be adapted to accommodate and hold differently sized cups through a proper conformation of the accommodations 8. To the turret 7 there are associated support means 13 cooperating with the first cup 10 of each stack 9 so as to support the entire stack within the accommodation 8 thereof. These support means 13 are placed on an end section of each accommodation 8 and are preferably connected in an oscillating manner to the turret 7; they are further preferably movable against the action of elastic means. These support means 13 may be provided in any number whatsoever, according to the conformation of the turret 7 and the cups.

A receptacle 11, comprising one or more compartments 12 adapted to receive the cups being removed from the stacks 9, is adapted to rotate about an axis so as to transfer said cups towards one or more dispensing sites 5. For reasons of greater simplicity, just a single stack 9 of cups, as arranged within an accommodation 8, and a receptacle 11 with a single compartment 12 have been represented in Figure 1. It will be readily

appreciated, however, that more than just a single stack 9 and just a single compartment 12 may be provided as well.

The vending machine 1 further comprises an arm 14, which, as best illustrated in Figures 2 and 3, is movable between a first release position, in which the arm 14 lays down a cup 10 into a compartment 12 of the receptacle 11 (Figure 2), and a second gripping position (Figure 3), in which the arm 14 removes a cup 10 from a stack 9 provided within an accommodation 8 of the turret 7. The arm 14 is mounted slidably on a runner 15 arranged so that the first cup-release position of the arm comes to be situated in the proximity of the receptacle 11 and the second cup gripping position of the arm lies in the proximity of the first cup 10 of each one of the stacks 9, i.e. the cup 10 that protrudes from the accommodation 8 in the turret 7. The runner 15 may be arranged so as to lie in correspondence to the longitudinal axis of rotation of the turret 7. The movement of the arm 14 between the above-mentioned first and second positions is imparted by driving means of a kind known as such in the art (and not shown in the Figures).

The arm 14 is further provided with a first jaw 16a and a second jaw 16b, which are movable reciprocally, i.e. relative to each other. This mutual position of the two jaws enables the arm 14 to accommodate different sizes of cups, whereas the same jaws moving apart from each other enable the cup they had previously picked from a stack 9 to be released into a compartment 12 of the receptacle 11.

Figure 4 illustrates the jaws 16a and 16b of the moving arm 14 and the support means 13 that are associated to the turret 7 in order to enable a cup 10 to be removed and released from a stack 9 of cups. The second jaw 16b comprises actuation means 17 that cooperate with the support means 13 to remove a cup 10 from a stack 9 of cups. These actuation means 17 may be provided either on a single one or both jaws 16a and 16b, depending on the arrangement of the support means 13 on the turret 7; in

a preferred manner, they consist of jutting parts. In addition, at least one of said jaws 16a and 16b comprises at least a moving hook 18 that gets caught between the upper edge 19 of the first cup 10 of a stack 9 and the upper edge 20 of the cup 10' immediately following said first cup 10 in said stack 9 when the arm 14 is in its second gripping position illustrated in Figure 3. In the case that more than a single hook 18 are provided, their number and arrangement on either the jaw 16a or the jaw 16b, or even both jaws 16a and 16b, may be selected so as to for instance most suitably fit a particular shape of the cups.

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Each moving hook 18 comprises a shoe 21 that is so shaped as to be adapted to slide on at least a surface 22 of the turret 7, thereby causing the same hook 18 to displace. Each such hook 18 is preferably movable against the action of elastic means.

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The support means 13, which are preferably connected in a swinging manner to the turret 7, comprise a retainer 25 that is so shaped as to be adapted to engage the upper edge 19 of the cup 10. For the actuation means 17 to be able to cooperate with these support means 13, the retainer 25, which the latter are provided with, is given a cam-like profile 26 for said actuation means 17 to slide thereon.

The actuation means 17, the support means 13, each hook 18 and the related shoe 21, as well as the surface 22 jointly form a cup release device.

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Three distinct moments in the operation of such cup release device are illustrated in Figures 5, 6 and 7. When the vending machine 1 is operated to prepare and dispense a given beverage selected by a buyer, or simply to remove and release a cup from the turret 7, the arm 14 is displaced along the runner 15 towards the second gripping position thereof illustrated in Figure 3. In this gripping position, the jaws 16a and 16b are suitably spaced apart so as to define a resting surface 23 for the upper edge 19 of the first cup 10 of a stack 9. The extent to which the jaws 16a and 16b are

spaced from each other, i.e. their position relative to each other, may be adjusted by means of an adjusting device so as to have the resting surface 23 more appropriately adapted to support cups having differently long upper edges 19. This ensures that the same arm 14 is able to work in conjunction with cups of widely varying shape and size.

With particular reference to Figures 4 and 5, as the arm 14 moves closer to its gripping position, the shoe 21 of each hook 18 moves into contact with the surface 22 of the turret 7. Owing to this surface 22 being preferably constituted by a fork-like structure 27 comprising at least a plane 24 that is inclined relative to the longitudinal axis of the turret 7, the shoe 21 is capable of sliding on this plane 24, thereby driving the hook 18 into moving. Each hook 18 is preferably formed by a plate having a first end portion bent in a hook-like manner and a second end portion that is pivotally connected to one of the two jaws 16a, 16b. In this manner, during the above-mentioned interaction of the shoe 21 with the inclined plane 24, the hook 18 is moved away from the jaws 16a, which it is associated to. During the phase in which the arm 14 moves closer to the gripping position thereof, while each hook 18 starts to move away from the respective jaws 16a or 16b which it is associated to, the actuation means 17 do not interact with the support means 13 that support the stack 9 of cups.

In the illustration appearing in Figure 6, the arm 14 is shown to have reached the position in which it is gripping the first cup 10 of the stack 9. The resting surface 23 is in contact with the upper edge 19 of the cup 10 and, under the circumstances, said surface 23 is supporting the entire stack 9 of cups, actually. In fact, the actuation means 17, by sliding along the cam-like profile 26, have caused the retainer 25 to disengage the upper edge 19 of the first cup 10 of the stack 9. The instant at which the retainer 25 releases the edge 19 is substantially the same as the one at which the latter enters into contact with the resting surface 23. Similarly, it is still substantially the same as the instant at which each hook 18



moves in between the upper edge 19 of the first cup 10 and the upper edge 20 of the next cup 10' following said first cup 10 in said stack 9.

The capability of each such hook 18 of getting so engaged between the  
5 upper edges of two successive cups in a stack is ensured by the fact that, at a moment at which the arm 14 has substantially already moved into the intended gripping position, the shoe 21 leaves the surface 22 of the turret 7, thereby enabling the hook 18 to move closer to the respective jaw 16a or 16b, which it is associated to. This approaching movement is  
10 favoured by elastic means, the potential energy of which is increased when the hook 18 moves away from the respective jaw (Figure 5), and is then released when the shoe 21 separates from the surface 22 by passing over the inclined plane 24 (Figure 6). As an alternative provision to said elastic means, each hook 18 may be constituted by a body that is capable of  
15 deflecting under a shear force without any rupture and/or permanent set.

Illustrated in Figure 7 is the arm 14 while it moves away from its gripping position upon having removed the cup 10 from the stack 9. Each hook 18 exerts a pulling force upon the cup 10, and its being so engaged  
20 between the upper edges 19 and 20 of two successive cups 10 and 10' ensures that a single cup at a time is removed from said stack 9. The arm 14 moving so away from the gripping position thereof enables the actuation means 17 to leave, i.e. separate from the cam-like profile 26, thereby enabling the retainer 25 to engage the upper edge 20 of the next  
25 cup 10' following the one that has just been removed from the stack 9. This stack 9 comes in this way to be again supported by the support means 13. Thanks to the particular conformation of the cam-like profile 26, at the very moment at which the cup 10 is removed from the stack 9, the support means 13 are capable of engaging the next cup 10', thereby  
30 sustaining again the stack 9 and pegging it in position.

The shoe 21 moves again into contact with the surface 22, but this time it does so from the opposite side of the inclined plane 24, as

compared with the direction of movement shown in Figure 6. In view of preventing the movement of the shoe 21 from being hindered, or made anyhow difficult, the surface 22 is preferably associated to the turret 7 pivotally, so that the same shoe is capable to displace the surface 22 at it  
5 slides away from the gripping position. Such displacement of the surface 22 caused by the shoe 21 has the sole effect of allowing an unhindered passage of the same shoe 21. As an alternative provision, the fork-like structure 27 of the surface 22 may be constituted by some thin plate that is capable of deflecting under a shear force without any rupture and/or  
10 permanent set.

Upon the cup 10 having so been removed from the stack 9, the arm 14 moves towards the release position thereof in the proximity of the receptacle 11, so as this is illustrated in Figure 2. The opening out of the  
15 jaws 16a and 16b, as brought about by the same motive means that drive the arm 14 to and from the gripping and release positions thereof, causes the cup 10 to be released and deposited into compartment 12 of said receptacle 11. If required, the cup 10 may then be conveyed - in a continuous manner or through a sequence of individual steps - from the  
20 receptacle 11 towards any device as may be provided for the preparation of hot or cold beverages, or towards any other device as may be provided to dispense loose edible products requiring being let into a cup prior to being vended out. The cup 10, as filled in this way with the desired product or - at most - even empty, will be eventually conveyed towards a  
25 delivery or dispensing site 5, which may possibly be common to the one of other dispensing devices comprised in the same vending machine 1, such as for instance a packaged-product dispensing device.

Fully apparent from the above description is therefore the ability of the  
30 the present invention to effectively reach the afore cited aims and advantages by providing a beverage vending machine with a cup release device that is effective in ensuring that just a single cup at a time is removed from a stack of cups, thereby avoiding any blocking-up problem

of the vending machine. Fully apparent is also the capability of the present invention of enabling a cup to be transferred in a controlled manner from the place in which it is stocked to the place in which the product to be dispensed is prepared, thereby preventing any product that  
5 may be possibly present in the cup itself from spilling out.

In addition, the present invention can advantageously work with widely varying types of cups, without any replacement of parts being actually required in the vending machine to this purpose.  
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It will be readily appreciated that the materials used, as well as the shapes and the sizing of the individual items, may each time be selected so as to more appropriately meet the particular requirements or suit the particular application, without departing from the scope of the present  
15 invention.

It will also be readily appreciated that the various elements constituting the present invention shall not necessarily be embodied in the sole forms as described above and illustrated with reference to the accompanying  
20 drawings, but may be embodied in a number of different forms, and be subject to a number of modifications and variants, without departing from the scope of the present invention.